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ABSTRACT

Intended for use by all welding instructors in the Metropolitan Nashville Public Schools, this guide provides a sequential listing of course content and scope. A course description provides a brief overview of the content of the courses offered in the welding program. General course objectives are then listed. Outlines of the course content are presented for these courses: welding I, II, and III. Suggested time and specific objectives are provided for each major topic. Topics include oxyacetylene cutting and brazing; arc welding; electrode classifications; vertical arc, overhead arc, gas metal arc, and gas tungsten arc welding; and employment opportunities. A brief listing of resource materials, which includes textbooks and a curriculum guide, is appended. (YLB)

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WELDING

SCOPE AND SEQUENCE

VOCATIONAL EDUCATION

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METROPOLITAN NASHVILLE PUBLIC SCHOOLS · EDUCATION FOR FREEDOM ·

Metropolitan Public Schools

Nashville Davidson County, Tennessee

Charles O. Frazier, Director

FOREWORD

This scope and sequence guide, developed for the Welding Vocational Education program, represents an initial step in the development of a systemwide articulated curriculum sequence for all vocational programs within the Metropolitan Nashville Public School System. It is a direct result of needs expressed by teachers, parents, and the business community for sequential structure within the vocational education curriculum. An articulated vocational curriculum allows a student to move from one level of instruction to the next without repeating learning tasks already mastered, and without experiencing gaps in the presentation of relevant instructional material.

A goal of this curriculum effort is to provide teachers a usable guide based on input from the teachers. The initial step was an identification of course content, with all teachers having an opportunity to contribute. What follows is a publication using the teachers' contributions: a sequential listing of objectives and skills for each program offering.

This guide does not include all specific resource materials that may be used to assist students in acquiring minimum competencies. It is to serve as a guide for the sequence of course content and scope of what is to be taught. This guide content is extremely important and its use is encouraged. The suggested competencies and resource materials allow instructors an opportunity to be creative and resourceful in meeting the needs of individual programs and students.

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INTRODUCTION

The materials contained in this outline have been mutually agreed upon by the instructors in the welding field as being important and necessary in providing a quality program in the Metropolitan Public School System. Topics have been arranged to provide for the necessary articulation between programs. It is further recognized that additions or modifications may be necessary in order to accommodate the individual differences within each program.

Each year, the material covered should be an advancement from the previous year, rather than a repetition.

COURSE DESCRIPTION

The course in Welding I gives the student an understanding of the history and development of welding and its importance in the development of the industry in this country. Students study welding principles; the physics and chemistry of welding; oxyacetylene cutting; oxyacetylene and braze welding; equipment, supplies and their applications to the welding process; arc welding using direct and alternating current.

In Welding II students study inert gas welding, TIG, and MIG; special welding processes and their application to ferrous and nonferrous metals; special cutting processes; metal surfacing; inspection and testing of welds; heat treating of metals; safety procedures for welders and many other aspects of the welding trade.

During Welding III detailed emphasis is placed on further training, specific skills, work attitudes and job placement. Students develop to a state of proficiency those skills required by industry, and learn professional and personal requirements necessary for job success.

Students have the opportunity to participate in VICA leadership training and in local, state and national competitions.

GENERAL COURSE OBJECTIVES

1. To teach safety procedures in the area of welding
2. To teach proper care and use of tools and equipment used in welding occupations
3. To teach students how to set up welding plates in different positions and different types of joints
4. To teach students how to cut and prepare plates to be welded
5. To teach students how to cut plates with different types of equipment and hand tools
6. To teach students how to weld plates with different types of electrodes and sizes
7. To teach students the purpose for different size, type and classification of welding electrodes
8. To teach students how to operate different types of welding machines using different types of current
9. To teach students optional methods for joining metal
10. To teach students how to test and identify the different types of metals they will be expected to weld and/or work with
11. To help create good attitudes of good citizenship and leadership through VICA
12. To make students aware of employment possibilities in the field of welding

COURSE CONTENT FOR WELDING I

(First Semester)

I. Orientation (6 weeks)

Specific objectives:

To become familiar with general rules, operation and shop safety
To learn the types and proper care of tools and equipment used in welding
To learn the proper procedure for setting up the cutting torch—the correct adjustment, proper pressure settings and the safe use of equipment

A. Studies rules and regulations

1. School policies

2. Shop policies

B. Understands attendance and grading policies

1. Grades and attendance

2. Grading scale

C. Studies safety processes of the shop

1. Tour of the shop

2. Location of safety equipment

3. General rules test

II. Oxyacetylene cutting (6 weeks)

Specific objectives:

To learn the different kinds of torches and the different sizes of tips
To learn how to safely use the different types of torches
To learn how to select and safely use the right size tip for different kinds of metal

A. Performs safety orientation

B. Makes set up

II. **Oxyacetylene cutting continued:**

C. Observes operation demonstration

D. Performs demonstration operation

E. Practices oxyacetylene cutting safety

F. Completes test

III. **Oxyacetylene brazing (6 weeks)**

Specific objectives:

To learn the difference between welding and braze welding
To learn how to do tinning and braze welding in all positions on different types of joints

A. Studies orientation and safety

B. Makes setup

C. Performs joints and fitup welds

D. Practices brazing positions

E. Completes review and test

COURSE CONTENT FOR WELDING I

(Second Semester)

I. **Arc welding (6 weeks)**

Specific objectives:

To learn the types of welding current
To learn how the select the current needed for a specific welding job

A. Studies orientation and safety

B. Analyzes types of welding current

C. Compares types of arc welding machines

D. Studies welding positions

II. **Electrode classifications and practice (10 weeks)**

Specific objectives:

To learn ways to identify different types of metal
To learn how to read AWS electrode classification numbers
To learn when to use different types, sizes and lengths of electrodes
To learn the proper procedure for selecting the right electrode

A. Compares types of electrode

B. Compares size of electrodes "length and diameter"

C. Studies AWS and ASTM classification by numbers

D. Studies welding positions for specific electrode

E. Studies types of welding joints

III. **Review (2 weeks)**

Specific objective:

To learn how to clean and perform maintenance on torches and tips

A. Operates cutting torch

III. **Review continued:**

B. Operates brazing torch

C. Operates welding machines

D. Makes welds on flat plates

E. Makes welds on flat lap joints

F. Makes welds on horizontal joints

G. Completes test on skills in welding

COURSE CONTENT FOR WELDING II

(First Semester)

I. **Review and orientation (6 weeks)**

Specific objectives:

To learn shop rules
To learn why oxyacetylene cutting is necessary for welders
To learn how to set up basic welding positions for safe operation

A. Reviews shop and school rules

B. Performs gas welding

C. Performs oxyacetylene cutting

D. Performs electric arc welding—flat horizontal and vertical positions

II. **Vertical arc welding (6 weeks)**

Specific objectives:

To learn when and how to prepare plate samples for vertical arc welding
To learn how to determine the right type joint for best results

A. Analyzes and performs lap joint welds

B. Analyzes and performs fillet joint welds

C. Analyzes and performs butt joint welds

III. **Overhead arc welding (6 weeks)**

Specific objectives:

To learn how to prepare plates for different types of joints and to use selected electrodes
To be made aware of the availability and use of a variety of electrodes

A. Analyzes and prepares different type joints

B. Selects proper type electrodes

COURSE CONTENT FOR WELDING II

(Second Semester)

I. Gas metal arc welding (6 weeks)

Specific objectives:

To understand the functions of machines, equipment, safety, upkeep and maintenance
To learn how to prepare plates
To learn how to properly set up and weld different type joints in all positions

A. Understands Gas Metal Arc Welding safety practices

B. Studies different alloy metals

C. Performs operation of machines and equipment

D. Welds different joints

E. Welds in all positions on plate

F. Welds pipe - 6G position

II. Gas tungsten arc welding (12 weeks)

Specific objectives:

To learn how to weld many types of metal with one machine
To learn to set and operate machines and equipment
To learn safety, proper care and use of machines and equipment

A. Understands Gas Tungsten Arc Welding safety practices

B. Performs operations of machines and equipment

C. Welds in all positions

D. Makes different weld joints

E. Completes review and test

COURSE CONTENT FOR WELDING III

(First and Second Semesters)

I. **Gas tungsten arc welding (18 weeks)**

Specific objectives:

To learn to identify the applications and advantages of gas tungsten arc welding
To learn to identify all major parts of the equipment and to name the function of each part
To become familiar with appropriate filler metals
To be made aware of the metallurgical properties of the base metals to be welded
To demonstrate the ability to set up gas tungsten arc welding equipment
To produce welds on popular metals in flat through vertical positions on common joints

A. Performs application of the process

B. Identifies the advantages of the process

C. Analyzes major controls of power supply

D. Analyzes types of welding current

E. Identifies major parts of a gas tungsten arc welding torch and machine

F. Uses gas cups for welding

G. Analyzes and uses various types of tungsten electrodes

H. Compares metallurgical factors in welding

1. Aluminum weld

2. Stainless steel weld

I. Analyzes and compares causes of poor welds

J. Analyzes characteristics of a good weld

K. Knows characteristics of argon and helium shielding gases

L. Sets up and constructs a variety of welds

II. **Gas metal arc welding (17 weeks)**

Specific objectives:

To learn to set up and shut down the gas metal arc welding process for three major applications
To identify power sources
To identify welding wires and shielding gases
To perform a variety of welds

A. Knows and uses gas metal arc welding terms

B. Knows advantages of the process

C. Knows major parts of gas metal arc welding equipment

D. Performs applications of the process

E. Selects a filler wire

F. Knows types of mild steel welding wires

G. Knows shielding gases

H. Analyzes common weld mistakes

I. Analyzes characteristics of a good weld

J. Knows and uses all types of power sources

K. Knows effects of electrode wire stick out on volts and amps

L. Performs set-up and shut-down of welding equipment

M. Constructs a variety of welds

III. **Employment opportunities (1 week)**

Specific objectives:

To be made aware of the job possibilities in welding
To become acquainted with the technique of securing and maintaining employment

A. Develops job opportunities file

B. Analyzes employment requirements for welding

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RESOURCE MATERIALS

Textbooks

Kennedy, Gower, A. Welding Technology. Indianapolis, Indiana: Howard W. Sames & Company, Inc., 1976.

Sacks, Raymond. Welding: Principles and Practices. Peoria, Illinois: Charles A. Bennett Company, Inc., 1976.

Curriculum Guides

Welding. Vocational Trade and Industrial Education, State Department of Vocational and Technical Education, Stillwater, Oklahoma, 1971, Revised 1974.